A New Species of Tiny Clam (Veneroida: Kelliellidae) Occurring Near Submerged Whale Carcasses

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Since twelve sperm whales that were stranded in 2002 on the western coast of Kyushu were deliberately placed on the nearby sea bottom at 200–300 m depth, the species composition and time-space successions of the fauna associated with the carcasses have been intensively investigated (see Fujiwara *et al*., 2007).

The faunal constituents in the surrounding sediment, including endobiotic deposit feeders, filter feeders and carnivores, were similar to the background fauna. However, some known inhabitants of reducing environments have occasionally been discovered, such as *Solemya, Lucinoma* and others, and they are assumed to prefer the environment generated by decomposing whale carcasses (Fujiwara *et al.*, 2007, 2009). The tiny clam treated here may be one of such species.

Abbreviations: JAMSTEC—Japan Agency for Marine-Earth Science and Technology, Yokosuka; NSMT — National Museum of Nature and Science, Tsukuba.

Taxonomy

Family Kelliellidae P. Fischer, 1887

***"Kelliella" ossisocia* n. sp.**
(Figs. 2–3)

Description: Shell small, veneriform, white, glossy, equivalve, subequilateral, ornamented by weak growth lines that are occasionally weakly lamellate, covered by filmy periostracum. Anterior, ventral and posterior margins smooth, roundly convex except for faint angle at meeting point of posterior margin and postero-dorsal margin. Umbo situated subcentrally, moderately prosogyrous, retaining vague outline of prodissoconch, *ca.* 500 μm in length. Ligament external, short, opisthodetic, sunken, but escutcheon barely discernible. Lunule well defined, demarcated by shallow incision.

Internal surface porcellaneous white with smooth margins. Anterior and posterior adductor scars subequal both in size and shape. Pallial line entire with no sinus. Hinge plate rather strong.

In right valve (Fig. 3), central cardinal tooth (1) low, crescent, horizontal shelf-like, overhung by anterior ramus of subumbonal cardinal tooth (3a) creating deep socket below 3a. Posterior ramus of subumbonal cardinal tooth (3b) also low, crescent, horizontal shelf-like, with slit above, which may be filled by thin brown tissue. In left valve, anterior ramus (2a) and posterior ramus (2b) of subumbonal cardinal tooth exhibit inverted V-shape, while anterior ramus (2a) with long footing and slit above. Socket between rami deep, triangular. Posterior cardinal tooth (4b) thick, oblique, ridge-like, bearing wide socket between this tooth and tooth 2b.

Type Material: Holotype, NSMT-Mo 77475 (*ex*-JAMSTEC 072598), *Hyper-Dolphin* Dive #682 (June 4, 2007), 31°20.73´N, 129°59.29´E, off Cape Noma-misaki, Satsuma Peninsula, Kyushu, 226 m depth (Fig. 1). Taken alive in black sediment rich in hydrogen sulfide, immediately underneath a whale vertebra settled in 2002.

Measurements of the holotype: Shell length 7.0 mm, shell height 5.6 mm, shell width 3.3 mm.

Etymology: The name came from the mode of occurrence of this new clam: *ossi* means bones, *-socia* denotes "associated".

Habitat: The whale bone-associated fauna has already been well summarized by Fujiwara *et al.* (2007). Diversity and abundance of epifauna decrease in the process of decomposition, while those of infauna increase relatively.

The present specimen was collected together with many groups of polychaetes and some individuals of the awning clam *Solemya pervernicosa* in the sediment beneath a vertebra of a whale (Fujiwara *et al.*, 2009). Since the sediment of this area was quite coarse, it did not seem to be organic-rich originally. However, the environmental condition in the sediment under the whale bones was assumed to be anaerobic because of the black

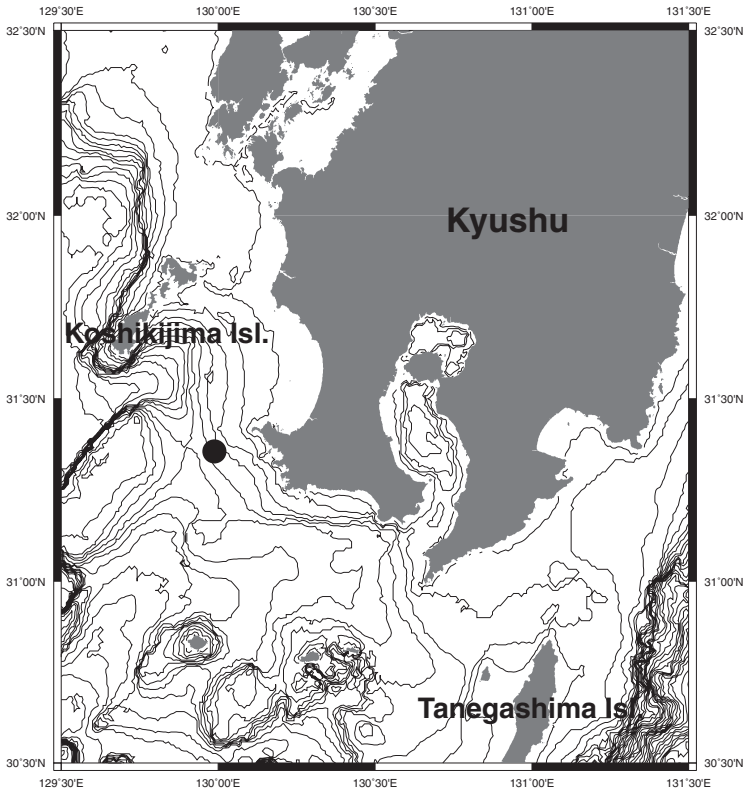

Fig. 1. Locality (filled circle) of "*Kelliella*" *ossisocia* n. sp.

color of the sediment and the occurrence of some species associated with reducing environments, including *S. pervernicosa*. On the whale vertebra, small but dense patches of the mytilid mussel *Adipicola* spp. were found (see Okutani *et al*., 2004).

Remarks: The systematic status of the genus *Kelliella* remains controversial. Although the genus is allocated to its own family, the Kelliellidae, its morphological similarity to the Vesicomyidae has frequently been pointed out (*e.g.,* Allen, 2001; Janssen & Krylova, 2012). Thus, the generic allocation of the present new species is tentative, but the preliminary molecular phylogenetic analyses of partial mitochondrial cytochrome oxydase subunit I (COI) sequence of the present specimen proved it to be an out-group of the Vesicomyidae clade (Fujiwara *et al*., unpublished).

Allen (2001) recognized two groups in the clade, supporting Boss's (1982) view: 1) Large (>50 mm), elongate, chalky shell; lunule present or lacking; both demibranchs present (*e.g*., *Calyptogena*, *Callogonia*), and 2) Small (<15 mm), globose shell; lunule well defined; outer demibranch lacking or reduced; no inhalant siphon present (*e.g*., *Kelliella*, *Vesicomya s.s*. and *Pauliella*). Coan *et al.* (2000) adopted a similar definition. Allen (*loc.cit.*) claimed that the Vesicomyidae Dall & Simpson, 1901 is preoccupied by Kelliellidae P. Fischer, 1887 if they are confamilial.

The present new species is safely placed in the genus *Kelliella sensu* Allen (2001). Members of the genus *Kelliella* are all tiny, and mostly bathyal to abyssal and even hadal. The occurrence of *Kelliella* from such a shallow depth (226 m) is quite unusual, although *Kelliella japonica* Hayami & Kase, 1993 lives in the submarine caves in Okinawa (20–32 m depth). This species has a veneriform profile and is more elongated than the most other deep-sea species of the genus, which is usually characterized by shorter and more globose shells with more prominent umbos and prosogyrous beaks, sometimes bearing commarginal lamellae (*e.g., K. japonica*).

The cardinal configuration of "*Kelliella*" *ossisocia* n. sp. is close to that of *Kelliella nitida* Verrill, 1885, but this abyssal Atlantic species has a shorter shell. *Kelliella tenina* Allen, 2001 from off

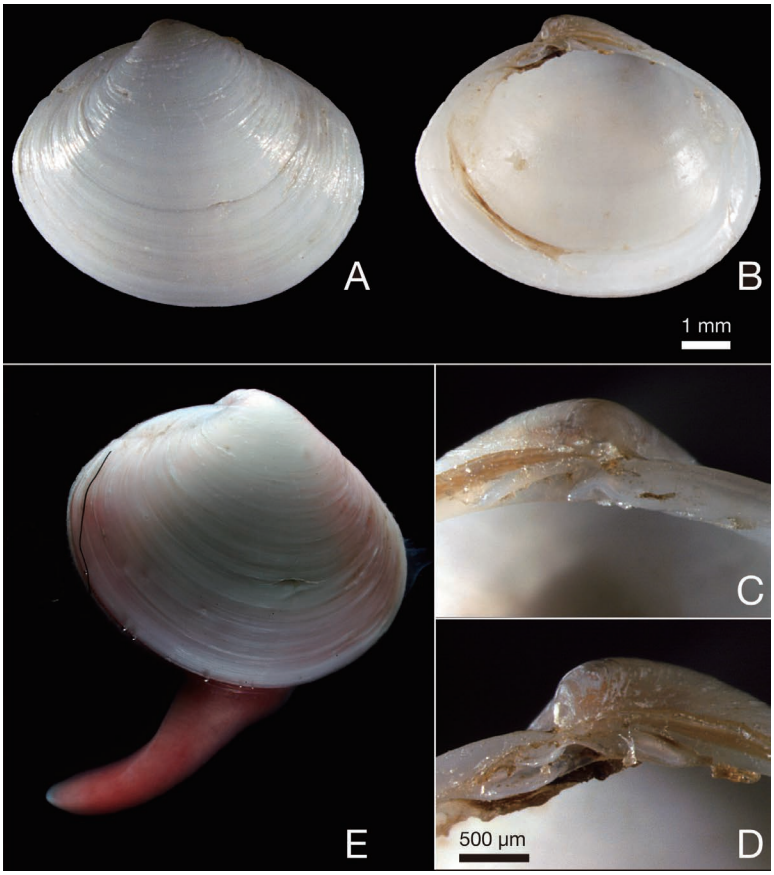

Fig. 2. Holotype specimen of "*Kelliella*" *ossisocia* n. sp.; **A**, left valve, external; **B**, right valve, internal; **C**, cardinal armature enlarged, left valve; **D**, cardinal armature enlarged, right valve; **E**, living state.

Walvis Bay, Nambia, at 1,014 m, bears a somewhat similarly elongated veneriform shell, but the latter is about half the size (SL 3.4 mm) of the present new species. The configuration of the cardinal teeth is similar between the two species, but the tooth 2b in *K. tenina* is blunter in comparison to the inverted V-shaped 2b in the present new species. It is regrettable that detailed comparisons of soft part anatomy could not be made, because the sole specimen (the holotype) was sacrificed for biochemical analyses prior to morphological scrutiny.

An abyssal species in Japanese waters, *Kelliella pacifica* (Smith, 1885), also has a round shell but has a different cardinal configuration. The subumbonal teeth in both valves are arched shelf-like in shape, similar to those of *Kelliella atlantica* (Smith, 1885) (Smith, 1885; Allen, 2001; Okutani & Kawamura, 2002).

The genus *Kelliella* is presumably polyphyletic and badly needs further systematic/phylogenetic

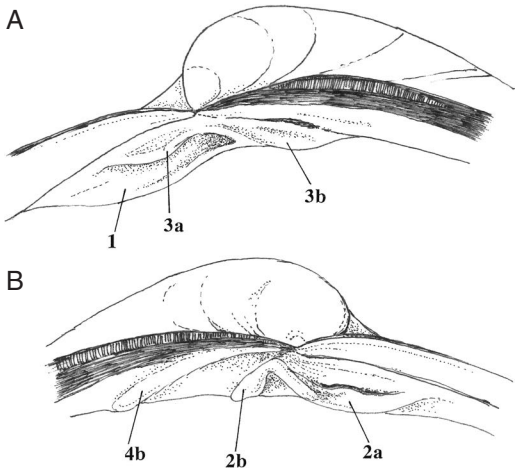

Fig. 3. Hinge of "*Kelliella*" *ossisocia* n. sp.; **A**, cardinal armature, right valve; **B**, cardinal armature, left valve.

revision, along with the family Kelliellidae.

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海底に沈下した鯨骨下に棲むゲイコツケシハマグリ（新種）

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要　約

2002 年に薩摩半島野間岬沖に沈設した鯨の遺骸下の硫化水素を豊富に含んだ海底沈積物中から発見された，微小なケシハマグリ科の 1 新種を記載する。

“*Kelliella” ossisocia* n. sp.　ゲイコツケシハマグリ（和名新称）

殻長 7 mm の微小種で，殻はハマグリ型で，同属の他種に比しやや前後に長く，且つ殻頂も秀いでない。殻表は白色で成長線は時に弱い褶状になり，極めて薄い殻皮を被る。小月面は浅い溝で区切られ，楯面は不分明。前後の閉殻筋痕は同型同大。外套湾入は無い。右殻の主歯は半月形で，弧状の殻頂下歯との間に深い歯槽が出来る。左殻の殻頂下歯は前肢は溝を伴った半月形であるが，後肢は逆 V 字型。後主歯は太く斜位。

本種は野間崎沖の水深 226 m から得られたホロタイプのみ知られる。鯨骨下の還元層に棲むと思われるが，本属の他種は漸深海底帯から超深海底帯から知られ，このように浅海からの出現は極めて異例である。本種は整ったハマグリ型であるが，既知種の多くは丸みが強く，殻頂部は著しく聳えて強く前傾する。*Kelliella* 属は多系統と思われるので，本種の属位は決定的ではない。チトクロームオキシダーゼ サブユニット 1（COI）遺伝子の部分長塩基配列に基づく予察的な分子系統解析（藤原・他，未発表）によれば，本種はオトヒメハマグリ類のクレードの外群となることが示されている。